

PATENT ABSTRACTS OF JAPAN

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(54) SURFACE MOUNTED TYPE PIEZOELECTRIC OSCILLATOR

(57)Abstract:

PROBLEM TO BE SOLVED: To avoid deterioration in an electric characteristic of a circuit element or the like or to allow deterioration in a connection state with the element to be hardly caused, to attain low profile for the oscillator, and to prevent occurrence of defective continuity and air-tightness due to a thermal distortion by separately making a part of a piezoelectric vibrator and an oscillation circuit part and connecting them electrically and mechanically through a combination in matching with a desired electric characteristic.

SOLUTION: A circuit component being an integrated circuit 7 is connected to a circuit component mounted on a lead frame 5 and electrically connected by bonding wires W or the like. Part of the lead frame 5 including the circuit component is molded by a resin and a projection 61 fitted to a recessed part 4 of the piezoelectric vibrator is provided to the front side. Furthermore, electrode pads 55, 56 are exposed to the front side of the oscillation circuit formed by a resin. The piezoelectric vibrator and the oscillation circuit are connected by fitting the recessed part 4 and the projection 61 and external lead-out electrodes 24, 25 and the electrode pads 55, 56 are bonded by a conductive bonding material electrically and mechanically.



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CLAIMS

[Claim(s)]

[Claim 1] The surface mount type piezo oscillator which consists of the leadframe and the oscillator-circuit section possessing the resin formation section to which the resin mould of the leadframe portion of the aforementioned circuit element portion was carried out which are characterized by providing the following, and comes to connect conductively the electrode pad section of the aforementioned oscillator-circuit section to the external leading electrode of the aforementioned piezoelectric-transducer section The pedestal which formed the external leading electrode in the inferior surface of tongue while consisting of an electric insulating plate and performing electrode wiring required for a front face and the interior The piezo-electric diaphragm in which the excitation electrode connected to the electrode wired on the front face of this pedestal electrically mechanically was formed The tipped type piezoelectric-transducer section possessing the cap who covers the piezo-electric diaphragm on the aforementioned front face of a pedestal, and is closed by jointing material in airtight The external derivation terminal which makes connection between the electrode pad section electrically joined to the external leading electrode of the aforementioned piezoelectric-transducer section, and the exterior while carrying this piezoelectric-transducer section, the circuit element which constitutes a desired oscillator circuit, and this circuit element

[Claim 2] The surface mount type piezo oscillator of the patent claim 1 publication characterized by preparing the concavo-convex section which fits into the piezoelectric-transducer section and the oscillator-circuit section mutually.

[Claim 3] The patent claim 1, the surface mount type piezo oscillator of two publications which are characterized by the thing of the piezoelectric-transducer section for which the lower part section was contained at least at this concave resin formation section using the oscillator-circuit section which has the concave resin formation section corresponding to the periphery configuration of the piezoelectric-transducer section.

[Claim 4] The patent claims 1 and 2, the surface mount type piezo oscillator of three publications which incorporated the temperature-compensation circuit which carries out temperature compensation of the electrical property of the piezoelectric-transducer section to the oscillator-circuit section, and compensated the electrical property of the piezoelectric-transducer section.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the surface mount type piezo oscillator taken into consideration also about low back-ization while taking into consideration the cure against a heat strain after loading to electronic equipment especially about a small surface mount type piezo oscillator.

[0002]

[Description of the Prior Art] It is required with the miniaturization of electronic equipment that it should be required that the piezo oscillator using piezoelectric transducers, such as a quartz resonator, should be mounted with high density [the overall height is low and] on a printed-circuit board, and it should moreover perform the mounting with an automatic machine. The movement considered as the chip type which formed electronic parts into lead loess with the thin shape to meet this demand was sudden. The chip type surface mount type crystal oscillator 9 as [shown in drawing 7] can make volume including an overall height small compared with electronic parts, such as a quartz resonator using the metal can which carried out hermetic sealing. In drawing 7, in the package 92 made from the ceramic which has crystal diaphragm loading section 9a and IC chip stowage 9b, the surface mount type crystal oscillator 9 contained the crystal diaphragm 91 of the AT cut by which excitation electrode formation was carried out, and the passive circuit elements 94, such as IC (integrated circuit) chip, was constituted, covered the cap 93 made from a ceramic to these crystal diaphragm etc., and was performing the hermetic seal with sealing agents, such as glass. Electronic parts other than a crystal diaphragm (an inverter, a capacitor, feedback resister, etc.) are IC-ized by IC chip, and constitute the piezo-electric oscillator circuit only from a crystal diaphragm and an IC chip in many cases in recently for it. In such a case, as shown in drawing 7, IC chip was contained in the package, and it had connected with the drawer electrode formed in the package by the bonding wire W electrically.

[0003]

[Problem(s) to be Solved by the Invention] The hermetic seal using above-mentioned glass has an advantage, like airtightness is comparatively high and there is little generating of gas detrimental to an electrode etc. However, its temperature used as jointing material was comparatively high, and though glass material used the low melting glass, the processing temperature of about 1 - 2 hours and time were required for it at 400 degreeC. On the other hand, when IC chip did not assume use in such environment in many cases and performed high temperature processing, change of an electrical property might arise for IC chip. Moreover, in the connection part C of the bonding wire of the gold electrically connected for example, with the aluminum electrode of IC chip, when the alloy layer of aluminum and gold may be formed under the influence of hot and such an alloy layer was formed, a part for a connection has a bird clapper easily mechanically, and was reducing the reliability of connection. Moreover, also in closure by the resin, and closure by solder, gas detrimental to the electrode of IC chip might occur. Furthermore, since the bending portion of a bonding wire was prolonged in the height direction of a crystal oscillator, the interval of a crystal diaphragm, IC chip, etc. needed to be secured to some extent in order to avoid contact to the excitation electrode of a crystal diaphragm. Such composition had become an obstacle at the time of forming the low back.

[0004] Moreover, although printing formation of the external leading electrode 95 is carried out at the ceramic package, and this VCO is carried in substrates, such as electronic equipment, in such a tipped type piezo oscillator and being soldered in the portion concerned The stress of expansion contraction of each component by change of ambient temperature and the stress at the time of division of a substrate It might join the soldering portion and the ceramic package directly, and airtight [by the crack of the glass the defective continuity or the ceramic package itself by crack initiation of a soldering portion, or for hermetic seals / poor] might occur.

[0005] While carrying out that this invention was made in order to solve the above-mentioned trouble,

electrical properties, such as a circuit element, do not worsen it, or it is hard to worsen a connection state with an element, it aims at it being suitable for low back-ization, and offering the defective continuity by heat strain, and the airtight poor surface mount type piezo oscillator which is not generated.

[0006]

[Means for Solving the Problem] In the surface mount type piezo oscillator, this invention produces separately the portion of a tipped type piezoelectric transducer, and an oscillator-circuit portion with a lead terminal, and is considering them as the composition which connected both electrically mechanically with the combination corresponding to the desired electrical property.

[0007]

[Embodiments of the Invention] The following composition is raised as a gestalt of operation of the surface mount type piezo oscillator by this invention. The pedestal which formed the external leading electrode in the inferior surface of tongue while consisting of ceramics and performing electrode wiring required for a front face and the interior as indicated by the claim 1, The piezo-electric diaphragm in which the excitation electrode connected to the electrode wired on the front face of this pedestal electrically mechanically was formed, While carrying the tipped type piezoelectric-transducer section possessing the cap who covers the piezo-electric diaphragm on the aforementioned front face of a pedestal, and is closed by jointing material in airtight, this piezoelectric-transducer section, the circuit element that constitutes a desired oscillator circuit, and this circuit element The electrode pad section electrically joined to the external leading electrode of the aforementioned piezoelectric-transducer section, The leadframe which has the external derivation terminal which makes connection with the exterior, and the leadframe portion of the aforementioned circuit element portion consist of the oscillator-circuit section possessing the resin formation section by which the resin mould was carried out. It is the composition of coming to connect conductively the electrode pad section of the aforementioned oscillator-circuit section to the external leading electrode of the aforementioned piezoelectric-transducer section.

[0008] By such composition, since it is the composition of having separated the piezoelectric-transducer portion and the oscillator-circuit portion, having influence of heat treatment (for example, glass closure) concerning manufacture of a piezoelectric transducer on an oscillator-circuit side is lost. Moreover, it does not have influence of discharge of the gas from the jointing material which starts installation of IC conversely etc. on a piezoelectric-transducer side. Since the piezoelectric transducer of further a tipped type is adopted, while a thin shape is realizable as a whole, the strain by the substrate to install can be eased with the external derivation terminal formed in the oscillator-circuit section.

[0009] Moreover, as shown in a claim 2, it is good also as composition which prepared the concavo-convex section which fits into the tipped type piezoelectric-transducer section and the oscillator-circuit section mutually. Or as shown in a claim 3, it is good for this concave resin formation section using the oscillator-circuit section which has the concave resin formation section corresponding to the periphery configuration of the piezoelectric-transducer section also as composition of the piezoelectric-transducer section which contained the lower part section at least.

[0010] By such composition, positioning concerning connection of the tipped type piezoelectric-transducer section and the oscillator-circuit section becomes easy, and improvement in manufacture efficiency can be expected.

[0011] As furthermore shown in a claim 4, it is good also as composition which incorporated the temperature-compensation circuit which carries out temperature compensation of the electrical property of the piezoelectric-transducer section to the oscillator-circuit section, and compensated the electrical property of the piezoelectric-transducer section.

[0012] By such composition, the oscillator-circuit section corresponding to the electrical property of a piezoelectric transducer can be combined, and the temperature-compensation piezo oscillator of the optimal combination can be obtained.

[0013]

[Example] Next, a surface mount type crystal oscillator is taken for an example about this invention, and it explains with reference to a drawing.

Although the 1st example drawing 1 is the decomposition perspective diagram of the surface mount type crystal oscillator in which the 1st example by this invention is shown and drawing 2 is an A-A cross section in the state where the piezoelectric-transducer section and the oscillator-circuit section were separated about drawing 1, the dotted line has indicated the external derivation terminal in part. A surface mount type crystal oscillator consists of the piezoelectric-transducer section and the oscillator-circuit section, piles these up, and is constituted in one.

[0014] The crystal diaphragm 1 which is a composition piezo-electricity board of the piezoelectric-transducer section comes to form a AT-cut quartz plate in the shape of a rectangle, and the excitation electrodes 11 and 12 (not shown about a rear face) are formed in a part for the center section on

the rear face of front so that thickness skid vibration may be made to perform. The drawer electrodes 11a and 12a (not shown about a rear face) are drawn from these excitation electrode by the longitudinal direction one side edge of a crystal diaphragm. It came to carry out laminating formation of the ceramics, electrode wiring required for the interior was performed, and the pedestal 2 which carries a crystal diaphragm in the upper part is exposed as the electrode pad which the part mentions later, and an external derivation terminal. The electrode pads 21, 22, and 23 which carry a crystal diaphragm are formed in the upper part of this pedestal, and an electrical signal is inputted into a crystal diaphragm through the electrode pads 21 and 22. Moreover, notching 2a and 2b (not shown [a part]) is formed in the side of this pedestal, and the external leading electrodes 24 and 25 (not shown [a part]) are pulled out here. The heights 61 of the below-mentioned oscillator-circuit section and the crevice 4 which fits in are formed in the direction of board thickness at a part for the base center section of a pedestal. In addition, a cap 3 consists of ceramics, has the composition of having the reverse crevice 31 which secures oscillating space, and is joined to the pedestal in airtight in low-melting-glass G.

[0015] The composition oscillator-circuit section of the oscillator-circuit section consists of at least one circuit element 7 carried in a leadframe 5 and this leadframe as a whole, and a resin 6 covered including these circuit element portion. A leadframe 5 consists of four external derivation terminals 51, 52, 53, and 54 connected with the exterior, and the electrode pads 55 and 56 exposed to the front face of the above-mentioned resin and the circuit element installation portions 57, and crookedness formation of each external derivation terminal is carried out so that it may have the operation which buffers the strain generated between the substrates carried. When the electrode pads 55 and 56 pile up the piezo-electric oscillating section, they are designed so that it may correspond with 1 of the above-mentioned external leading electrodes 24 and 25, respectively. The circuit element installed in the circuit element loading section of a leadframe is an integrated circuit (IC) 7, and electrical installation required of a bonding wire W etc. is made. This circuit element may adopt two or more elements if needed. While carrying out the resin mould of a part of leadframe including this circuit element, the crevice of the above-mentioned piezoelectric-transducer section and the heights 61 which fit in are formed in the front face. In addition, the electrode pads 55 and 56 are exposed to the front face of the oscillator-circuit section by which resin formation was carried out.

[0016] Such the piezoelectric-transducer section and the oscillator-circuit section are joined by making the above-mentioned crevice and heights fit in, and electric mechanical junction of the external leading electrodes 24 and 25 and the electrode pads 55 and 56 is carried out by conductive jointing material, respectively. By such composition, since it is the composition of having separated the piezoelectric-transducer portion and the oscillator-circuit portion, having influence of heat treatment (for example, glass closure) concerning manufacture of a piezoelectric transducer on an oscillator-circuit side is lost. Moreover, it does not have influence of discharge of the gas from the jointing material which starts IC installation conversely etc. on a piezoelectric-transducer side. Since the piezoelectric transducer of further a tipped type is adopted, while a thin shape is realizable as a whole, the strain by the substrate to install can be eased with the external connection lead formed in the oscillator-circuit section. In addition, in the above-mentioned explanation, although ceramic material was illustrated and explained as a package material of the piezoelectric-transducer section, you may use insulating materials, such as resin material. Moreover, you may be the composition which makes the configuration of a pedestal the shape of a concave as a whole, forms a periphery-like metal ring in a part for the opening, and carries out weldbonding with a metallic cap also with the composition of a package.

[0017] The 2nd example drawing 3 is the direction side elevation of a shorter side showing the 2nd example by this invention. Since it is the same composition in the 1st example and almost all portions, explanation is explained using a jack per line in part while omitting. In addition, suppose that it is the same also about subsequent examples. It is good also as composition which carried out extension formation of the electrode pads 57 and 58 of the oscillator-circuit section. After this assembles the piezoelectric-transducer section and the oscillator-circuit section, the electrical property of a piezoelectric-transducer section simple substance can be measured, and investigation at the time of fault generating can be conducted easy. Moreover, the application situation of the conductive jointing material S can be clearly checked by carrying out extension formation of the electrode pad.

[0018] The 3rd example drawing 4 is the side elevation showing the 3rd example by this invention. Two or more crevices 41 and 42 are established in the piezo-electric oscillating section, two or more heights 62, 63 are formed also in the oscillator-circuit section, and both are joined by making these fit in. Since it is fixation by two or more positioning, the improvement in position precision at the time of junction can be expected.

[0019] The 4th example drawing 5 and drawing 6 are the side elevations showing the 4th two example by this invention. The crevice 64 corresponding to the periphery configuration of the piezoelectric-transducer

section is established in the front face of the oscillator-circuit section by resin formation, an electrode pad is prepared in this crevice, and the example given in drawing 5 is performing electric junction in the piezoelectric-transducer section. Moreover, an example given in drawing 6 establishes a crevice 65 in the lower part of the oscillator-circuit section, and has become this portion with the composition which carries out insertion installation of the piezoelectric-transducer section from a lower part. Moreover, the external derivation terminal of a leadframe is composition derived from the side upper part of the oscillator-circuit section, and has composition which also arranges a circuit element 7 beside the piezoelectric-transducer section. As for any example, installation of the piezoelectric-transducer section has the advantage which becomes easy. Although the distance of an external derivation terminal and the substrate carried becomes small too much and the buffer action by the external derivation terminal may not fully be acquired when a thin thing is especially used for the piezoelectric-transducer section, in such a case, sufficient buffer action can be acquired with it being the composition shown in drawing 6.

[0020] In example above-mentioned each 5th composition, it is good also as composition which incorporated the temperature-compensation circuit which carries out temperature compensation of the electrical property of the piezoelectric-transducer section to the oscillator-circuit section, and compensated the electrical property of the piezoelectric-transducer section. For example, in near anticipated-use temperature, a AT-cut quartz resonator shows the frequency temperature characteristic expressed with the 3rd curve, or shows the frequency temperature characteristic expressed with primary approximation curves. The piezo oscillator of practical temperature compensation can be obtained by preparing the combination of the temperature-compensation circuit element which was made to carry out temperature compensation of this appropriately to the quartz resonator which has the frequency temperature characteristic distinguishable to such two or more sorts, and offering the oscillator-circuit section according to the property of a quartz resonator. What is necessary is just to choose the circuitry and the constant which made these correspond to the property of the piezoelectric-transducer section, although there are a thermistor, a capacitor, resistance, etc. as a temperature-compensation circuit element.

[0021]

[Effect of the Invention] Since it is the composition of having separated the piezoelectric-transducer portion and the oscillator-circuit portion according to this invention, having influence of heat treatment (for example, glass closure) concerning manufacture of a piezoelectric transducer on an oscillator-circuit side is lost. Moreover, it does not have influence of discharge of the gas from the jointing material which starts IC installation conversely etc. on a piezoelectric-transducer side. Since the piezoelectric transducer of further a tipped type is adopted, while a thin shape is realizable as a whole, the strain by the substrate to install can be eased with the external connection lead formed in the oscillator-circuit section, and the defective continuity by heat strain and airtight poor generating can be prevented. Therefore, the reliability of a surface mount type piezo oscillator can be raised.

[0022] Moreover, as shown in claims 2 and 3, by composition which fits in the tipped type piezoelectric-transducer section and the oscillator-circuit section, positioning concerning connection of the tipped type piezoelectric-transducer section and the oscillator-circuit section becomes easy, and improvement in manufacture efficiency can be expected.

[0023] As furthermore shown in a claim 4, by incorporating the temperature-compensation circuit which carries out temperature compensation of the electrical property of the piezoelectric-transducer section to the oscillator-circuit section, and considering as the composition which compensated the electrical property of the piezoelectric-transducer section, the oscillator-circuit section corresponding to the electrical property of a piezoelectric transducer can be combined, and the temperature-compensation piezo oscillator of a practical combination can be obtained.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The decomposition perspective diagram showing the 1st example of the surface mount type piezo oscillator by this invention.

[Drawing 2] The A-A cross section of drawing 1.

[Drawing 3] Drawing showing the 2nd example.

[Drawing 4] Drawing showing the 3rd example.

[Drawing 5] Drawing showing the 4th example.

[Drawing 6] Drawing showing the 4th example.

[Drawing 7] Drawing showing the conventional example.

[Description of Notations]

1 81 Piezo-electric diaphragm (crystal diaphragm)

2 Nine Pedestal

3 91 Cap

4, 41, 42, 64, 65 Crevice

5 Leadframe

6 Resin

61, 62, 63 Heights

7 Circuit Element

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(54) 【発明の名称】 表面実装型圧電発振器

(57) 【特許請求の範囲】

【請求項 1】 絶縁板からなり、表面及び内部に必要な電極配線を施すとともに下面に外部導出電極を形成した基台と、この基台の表面に配線された電極に、電気的機械的に接続される励振電極の形成された圧電振動板と、前記基台表面の圧電振動板を被覆し、接合材により気密的に封止されるキャップを具備するチップ型圧電振動子部と、
この圧電振動子部と所望の発振回路を構成する回路素子と、この回路素子を搭載するとともに、前記圧電振動子部の外部導出電極と電気的に接合される電極パッド部と、外部との接続を行う外部導出端子とを有するリードフレームと、前記回路素子部分のリードフレーム部分が樹脂モールドされた樹脂形成部を具備する発振回路部とからなり、

前記圧電振動子部の外部導出電極と前記発振回路部の電極パッド部を導電接続してなる表面実装型圧電発振器。

【請求項 2】 圧電振動子部と発振回路部に互いに嵌合する凹凸部を設けたことを特徴とする特許請求項 1 記載の表面実装型圧電発振器。

【請求項 3】 圧電振動子部の外周形状に対応した凹形の樹脂形成部を有する発振回路部を用い、この凹形の樹脂形成部に圧電振動子部の少なくとも下方部を収納したことを特徴とする特許請求項 1, 2 記載の表面実装型圧電発振器。

【請求項 4】 発振回路部に圧電振動子部の電気的特性を温度補償する温度補償回路を組み込み、圧電振動子部の電気的特性を補償した特許請求項 1, 2, 3 記載の表面実装型圧電発振器。

【発明の詳細な説明】

(2)

【0001】

【発明の属する技術分野】本発明は小型の表面実装型圧電発振器に関し、特に電子機器への搭載後の熱ひずみ対策を考慮するとともに、低背化についても考慮された表面実装型圧電発振器に関するものである。

【0002】

【従来の技術】電子機器の小型化に伴い、水晶振動子等の圧電振動子を用いた圧電発振器はその全高が低くかつプリント配線基板上に高密度に実装されることが要求され、しかもその実装は自動機によって行うことが要求されている。この要求に応えるべく電子部品を薄型でリードレス化したチップタイプとする動きが急となっていた。図7に示すようなチップタイプの表面実装型水晶発振器9は、金属製のキャンを用いたハーメチックシールドした水晶振動子等の電子部品に較べて、全高を始めとする体積を小さくすることができる。図7において、表面実装型水晶発振器9は、水晶振動板搭載部9aとICチップ収納部9bを有するセラミック製のパッケージ92内に、励振電極形成されたATカットの水晶振動板91と、IC（集積回路）チップ等の回路部品94を収納して構成され、セラミック製のキャップ93をこれら水晶振動板等に被覆し、ガラス等の封止材で気密封止を行っていた。ICチップには、水晶振動板以外の電子部品（インバータ、コンデンサ、帰還抵抗等）がIC化されており、最近においては水晶振動板とICチップのみで圧電発振回路を構成している場合が多い。このような場合、図7に示すようにICチップをパッケージに収納し、ボンディングワイヤーWでパッケージに形成された引出電極と電気的に接続していた。

【0003】

【発明が解決しようとする課題】上述のガラスを用いた気密封止は、比較的気密性が高く、電極等に有害なガスの発生が少ない等の利点を有している。しかしながらガラス材は接合材として用いる温度が比較的高く、低融点ガラスを用いたとしても400°Cで1～2時間程度の処理温度、時間が必要であった。一方、ICチップはこのような環境での使用は想定していない場合が多く、高温処理を行った場合、ICチップに電気的特性の変化が生じることがあった。また、ICチップの例えばアルミニウム電極と電気的に接続される金のボンディングワイヤーの接続部分Cにおいて、高温の影響でアルミニウムと金の合金層が形成されることがあり、このような合金層が形成されると接続部分が機械的にもろくなることがあり、接続の信頼性を低下させていた。また、樹脂による封止、半田による封止においてもICチップの電極に有害なガスが発生することがあった。さらに、ボンディングワイヤーの撓み部分が、水晶発振器の高さ方向に延びているために、水晶振動板の励振電極との接触を避ける目的で水晶振動板とICチップ等との間隔をある程度確保する必要があった。このような構成は低背化する際

の障害になっていた。

【0004】また、このようなチップ形の圧電発振器において、外部導出電極95はセラミックパッケージに印刷形成されており、この発振器を電子機器等の基板に搭載し、当該部分にて半田付けを行うが、周囲温度の変動による各構成部分の膨張収縮の応力や基板の分割時の応力が、半田付け部分やセラミックパッケージに直接加わり、半田付け部分のクラック発生による導通不良やセラミックパッケージ自体や気密封止用のガラスの割れによる気密不良が発生することがあった。

【0005】本発明は上記問題点を解決するためになされたもので、回路素子等の電気的特性の悪化させず、あるいは素子との接続状態を悪化させにくくするとともに、低背化に適し、かつ熱ひずみによる導通不良、気密不良の発生しない表面実装型圧電発振器を提供することを目的とするものである。

【0006】

【課題を解決するための手段】本発明は、表面実装型圧電発振器において、チップ形圧電振動子の部分と、リード端子付きの発振回路部分とを別々に作製し、所望の電気的特性に合致した組み合わせにより両者を電気的機械的に接続した構成としている。

【0007】

【発明の実施の形態】本発明による表面実装型圧電発振器の実施の形態として次のような構成があげられる。請求項1に記載されているように、セラミックスからなり、表面及び内部に必要な電極配線を施すとともに下面に外部導出電極を形成した基台と、この基台の表面に配線された電極に、電気的機械的に接続される励振電極の形成された圧電振動板と、前記基台表面の圧電振動板を被覆し、接合材により気密的に封止されるキャップを具備するチップ型圧電振動子部と、この圧電振動子部と所望の発振回路を構成する回路素子と、この回路素子を搭載するとともに、前記圧電振動子部の外部導出電極と電気的に接合される電極パッド部と、外部との接続を行う外部導出端子とを有するリードフレームと、前記回路素子部分のリードフレーム部分が樹脂モールドされた樹脂形成部を具備する発振回路部とからなり、前記圧電振動子部の外部導出電極と前記発振回路部の電極パッド部を導電接続してなる構成である。

【0008】このような構成により、圧電振動子部分と発振回路部分とを分離した構成であるので、圧電振動子の製造に係る熱処理（例えばガラス封止）の影響を発振回路側に与えることがなくなる。また、逆にICの設置に係る接合材からのガスの放出等の影響を圧電振動子側に与えることがない。さらにチップ型の圧電振動子を採用しているので、全体として薄型が実現できるとともに、発振回路部に形成された外部導出端子により、設置する基板とのひずみを緩和することができる。

【0009】また、請求項2に示すように、チップ型圧

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電振動子部と発振回路部に互いに嵌合する凹凸部を設けた構成としてもよい。あるいは請求項3に示すように、圧電振動子部の外周形状に対応した凹形の樹脂形成部を有する発振回路部を用い、この凹形の樹脂形成部に圧電振動子部の少なくとも下方部を収納した構成としてもよい。

【0010】このような構成により、チップ型圧電振動子部と発振回路部の接続に係る位置決めが容易になり、製造効率の向上が見込める。

【0011】さらに請求項4に示すように、発振回路部に圧電振動子部の電気的特性を温度補償する温度補償回路を組み込み、圧電振動子部の電気的特性を補償した構成としてもよい。

【0012】このような構成により、圧電振動子の電気的特性に対応した発振回路部を組み合わせることができ、最適な組み合わせの温度補償型圧電発振器を得ることができる。

【0013】

【実施例】次に、本発明について表面実装型の水晶発振器を例にとり、図面を参照して説明する。

第1の実施例

図1は本発明による第1の実施例を示す表面実装型水晶発振器の分解斜視図であり、図2は図1について圧電振動子部と発振回路部を分離した状態のA-A断面図であるが、一部外部導出端子を点線で記載している。表面実装型水晶発振器は圧電振動子部と発振回路部からなり、これらを重ね合わせて一体的に構成される。

【0014】圧電振動子部の構成

圧電板である水晶振動板1はATカット水晶板を矩形状に形成してなり、厚みすべり振動を行わしめるようその表裏面の中央部分に励振電極11、12（裏面については図示せず）が形成されている。これら励振電極からは、水晶振動板の長手方向一方端に引出電極11a、12a（裏面については図示せず）が導出されている。水晶振動板をその上部に搭載する基台2はセラミックスを積層形成してなり、その内部に必要な電極配線が施され、その一部が後述する電極パッド、外部導出端子として露出している。この基台の上部には水晶振動板を搭載する電極パッド21、22、23が形成され、電極パッド21、22を通じて、水晶振動板に電気信号が入力される。また、この基台の側面には切り欠き2a、2b（一部図示せず）が設けられ、ここに外部導出電極24、25（一部図示せず）が引き出されている。基台の底面中央部分には後述の発振回路部の凸部61と嵌合する凹部4が板厚方向に設けられている。なお、キャップ3はセラミックスからなり、振動空間を確保する逆凹部31を有する構成となっており、低融点ガラスGにて基台と気密的に接合されている。

【0015】発振回路部の構成

発振回路部は、全体としてリードフレーム5とこのリー

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ドフレームに搭載される少なくとも1つの回路素子7とこれら回路素子部分を含んで被覆される樹脂6とからなる。リードフレーム5は、外部と接続される4つの外部導出端子51、52、53、54と、前述の樹脂の表面に露出する電極パッド55、56と回路素子設置部分57とからなり、各外部導出端子は搭載される基板との間に発生するひずみを緩衝する作用を有するよう、屈曲形成されている。電極パッド55、56は圧電振動部を重ね合わせた際、それぞれ前述の外部導出電極24、25の一と対応するように設計されている。リードフレームの回路素子搭載部に設置される回路素子は集積回路（IC）7であり、ボンディングワイヤーW等にて必要な電気的接続がなされている。この回路素子は必要に応じて、複数個の素子を採用してもよい。この回路素子を含んでリードフレームの一部を樹脂モールドするとともに、表面には前述の圧電振動子部の凹部と嵌合する凸部61が設けられている。なお、電極パッド55、56は樹脂形成された発振回路部の表面に露出している。

【0016】このような圧電振動子部と発振回路部とを、前述の凹部、凸部を嵌合させることにより接合し、かつ外部導出電極24、25と電極パッド55、56とをそれぞれ導電性接合材で電気的機械的接合する。このような構成により、圧電振動子部分と発振回路部分とを分離した構成であるので、圧電振動子の製造に係る熱処理（例えばガラス封止）の影響を発振回路側に与えることがなくなる。また、逆にIC設置に係る接合材からのガスの放出等の影響を圧電振動子側に与えることがない。さらにチップ型の圧電振動子を採用しているので、全体として薄型が実現できるとともに、発振回路部に形成された外部接続リードにより、設置する基板とのひずみを緩和することができる。なお、上記説明において、圧電振動子部のパッケージ材料として、セラミックス材料を例示して説明したが、樹脂材料等の絶縁材料を用いてもよい。また、パッケージの構成についても、基台の形状を全体として凹形状とし、その開口部分に周状の金属リングを形成し、金属性のキャップにて溶接接合する構成であってもよい。

【0017】第2の実施例

図3は本発明による第2の実施例を示す短辺方向側面図である。第1の実施例とほとんどの部分において同じ構成であるので、一部説明は省略するとともに、同番号を用いて説明する。なお、以降の実施例についても同様とする。発振回路部の電極パッド57、58を伸長形成した構成としてもよい。これにより圧電振動子部と発振回路部を組み立てた後においても、圧電振動子部単体の電気的特性を測定することができ、不具合発生時の調査を容易にすることができる。また、電極パッドが伸長形成されていることにより、導電性接合材Sの塗布状況を明確に確認することができる。

【0018】第3の実施例

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図4は本発明による第3の実施例を示す側面図である。圧電振動部には2以上の凹部41、42が設けられ、発振回路部にも2以上の凸部62、63が設けられており、これらを嵌合させることにより両者の接合を行う。複数箇所の位置決めによる固定であるので、接合時の位置精度向上が見込める。

【0019】第4の実施例

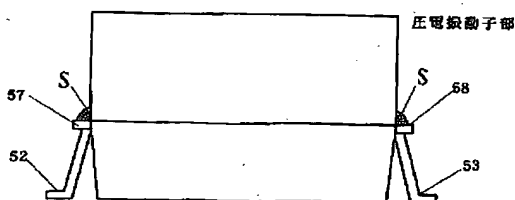
図5、図6は本発明による2つの第4の実施例を示す側面図である。図5に記載の実施例は、発振回路部の表面には圧電振動子部の外周形状に対応した凹部64が樹脂形成により設けられており、この凹部内に電極パッドが設けられ、圧電振動子部との電気的接合を行っている。また、図6に記載の実施例は、発振回路部の下部に凹部65を設け、この部分に圧電振動子部を下方から挿入設置する構成となっている。また、リードフレームの外部導出端子は発振回路部の側面上部から導出する構成であり、また回路素子7も圧電振動子部の横に配置する構成となっている。いずれの実施例も圧電振動子部の設置が容易になる利点を有している。特に、圧電振動子部に薄型のものを用いた場合、外部導出端子と搭載される基板との距離が小さくなりすぎ、外部導出端子による緩衝作用が十分に得られないことがあるが、このような場合、図6に示す構成であると充分な緩衝作用を得ることができる。

【0020】第5の実施例

上記各構成において、発振回路部に圧電振動子部の電気的特性を温度補償する温度補償回路を組み込み、圧電振動子部の電気的特性を補償した構成としてもよい。例えばATカット水晶振動子は、通常の使用温度付近において、3次曲線で表される周波数温度特性を示したり、1次近似曲線で表される周波数温度特性を示したりする。このような複数種に区別できる周波数温度特性を有する水晶振動子に対して、これを適切に温度補償するようにした温度補償回路素子の組み合わせを用意しておき、水晶振動子の特性に合わせて、発振回路部を提供することにより、実用的な温度補償型の圧電発振器を得ることができる。温度補償回路素子としてはサーミスタ、コンデンサ、抵抗等があるが、これらを圧電振動子部の特性に対応させた回路構成、定数を選択すればよい。

【0021】

【図3】



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【発明の効果】本発明によれば、圧電振動子部分と発振回路部分とを分離した構成であるので、圧電振動子の製造に係る熱処理（例えばガラス封止）の影響を発振回路側に与えることがなくなる。また、逆にIC設置に係る接合材からのガスの放出等の影響を圧電振動子側に与えることがない。さらにチップ型の圧電振動子を採用しているので、全体として薄型が実現できるとともに、発振回路部に形成された外部接続リードにより、設置する基板とのひずみを緩和し、熱ひずみによる導通不良、気密不良の発生を防止することができる。よって、表面実装型圧電発振器の信頼性を向上させることができる。

【0022】また、請求項2、3に示すように、チップ型圧電振動子部と発振回路部を嵌合する構成により、チップ型圧電振動子部と発振回路部の接続に係る位置決めが容易になり、製造効率の向上が見込める。

【0023】さらに請求項4に示すように、発振回路部に圧電振動子部の電気的特性を温度補償する温度補償回路を組み込み、圧電振動子部の電気的特性を補償した構成とすることにより、圧電振動子の電気的特性に対応した発振回路部を組み合わせることができ、実用的な組み合わせの温度補償型圧電発振器を得ることができる。

【図面の簡単な説明】

【図1】本発明による表面実装型圧電発振器の第1の実施例を示す分解斜視図。

【図2】図1のA-A断面図。

【図3】第2の実施例を示す図。

【図4】第3の実施例を示す図。

【図5】第4の実施例を示す図。

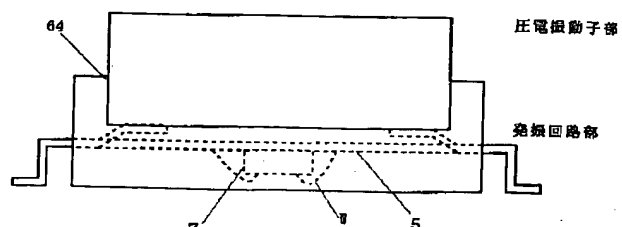
【図6】第4の実施例を示す図。

【図7】従来例を示す図。

【符号の説明】

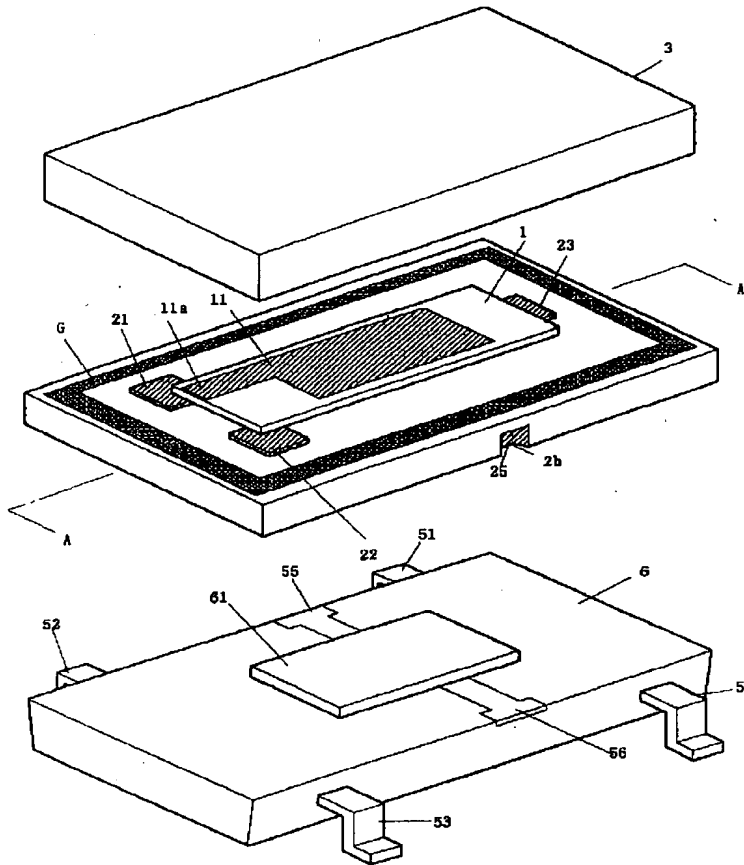
- 1, 8.1 圧電振動板（水晶振動板）
- 2, 9 基台
- 3, 9.1 キャップ
- 4, 4.1, 4.2, 6.4, 6.5 凹部
- 5 リードフレーム
- 6 樹脂
- 6.1, 6.2, 6.3 凸部
- 7 回路素子

【図5】

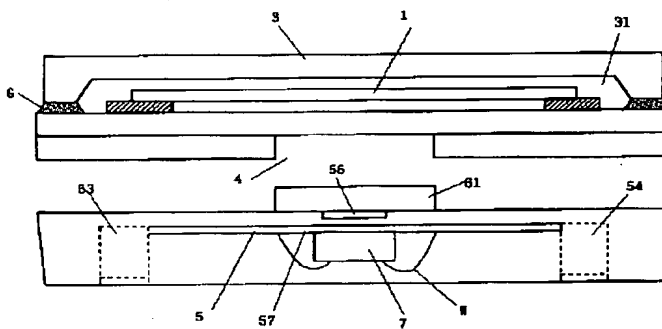


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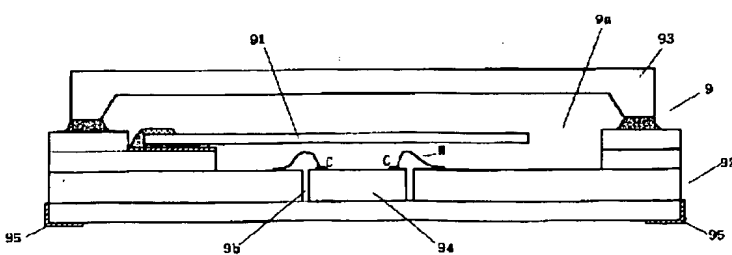
【図1】



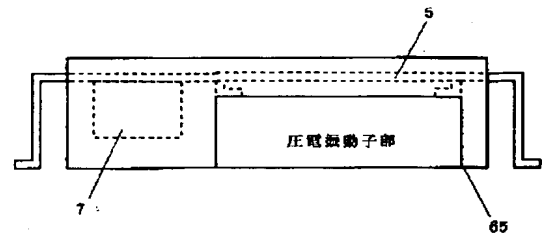
【図2】



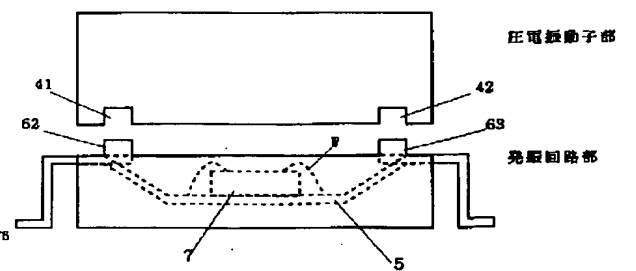
【図7】



【図6】



【図4】



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